THE DISTRIBUTION OF THE STOCK AND THE TREND OF THE CATCHES OF CARP IN THE HUNGARIAN DANUBE SECTION

(DANUBIALIA HUNGARICA LXXI)

by

JÁNOS TÓTH

Hungarian Danube Research Station, Göd

Received on November 10th, 1972

On the biological bases and mechanism of the fish production of the Danube, some time ago A n t i p a drew up several most valuable comprehensive summaries with special regard to the ecology of carp. This Danube ichthyologist of imperishable merit conducted his observations in the lower Danube basin at a time when it was still in a relatively natural condition. His studies basically cleared up the ecological connections between the autochthonous population of carp and the hydrological and hydrogeographic conditions of the lower section of the Danube. In full detail he revealed the important function which the main branch and the inundation areas as well as the extensive lakes in the latter had in the propagation, feed and growth of carp. Although his work covered expressly the Roumanian section of the Danube, in many respects it permitted to draw analogies with the ecology of carp in the middle basin of the river, especially as to its lower part. These analogies and the course of the mechanism of fish production in the lower part of the Pannonian plain were described by S t a n k o v i č who gave a detailed survey on the conditions of fish production of the great rivers of that region.

The works of both researchers had been written at a time when the Danube sections examined and assessed by them were still in a relatively natural condition as against the one prevailing today, hardly influenced by river regulation and industrial sewages. However, since their activity and the publication of their studies on the subject radical changes have taken place in the whole of the Danube.

The mechanism and ecological conditions of the fish production in the Hungarian section of the Danube had differed already in their original and natural state from those described by A n t i p a and S t a n k o v i č just as the section of the middle Danube also differs in the hydrographic sense from those below same. Still, by now it can be stated that in consequence of the huge changes ensued sicne then, the conditions of that time can be sooner compared with the mechanism of fish production in the lo-

wer Danube than with the contemporary ecological conditions of the same region. – This situation still prevails in the Yugoslavian and Rumanian Danube sections, since rather significant changes have taken place there, too. Also the recently published work of M. R i s t i č deals with this; in the author strives to find an answer to the question of how the original rich condition of fish production in the Yugoslavian Danube section could be restored at least in part by way of reconstructing the flood plains and the waters located in them.

As a biotop of carp, the Hungarian Danube section could be divided into two parts also in its natural condition. One of these parts is situated in the regions bordering upon Austria and Czechoslovakia. The most charakteristic hydrographic feature of it is a relatively high gradient: 30–40 cm. per kilometre. Below that part, the degree of slope does not differ from the gradient conditions to be observed in the lower Pannonian plain and in the lower Danube basin: it does not surpass 8–12 cm. anywhere. In its original and natural condition this part of the river had extensive inundation areas, branches and lakes in the flood plains. Still, in consequence of river regulation begun about the middle of the past century, the flood plains had been liquidated nearly everywhere, the lakes of these areas had been filled up, and in the resulting new situation also the beds of the branches still in connection with the Danube became silted up. When considering the situation of today, one can determine three well differentiating parts in the Hungarian section of the Danube. The first of these extends from the upper Hungarian frontier (the 1850th river kilometre) to Gönyü (the 1791st river kilometre). As compared with the original, natural condition, it is the next part downwards (i. e. the middle Danube taken in the Hungarian sense) that has changed most, as regards both regulation and contamination. This part extends from Gönyü (1971st river kilometre) to Dunaföldvár (1650th river kilometre). In consequence of a thoroughly executed work of regulation, the Danube has no inundation area in this part, side branches and backwaters are of but rather limited extent and highly silted. In addition, as a consequence of industrial activity concentrated in the regions above and below Budapest, this part also has to take up the greatest quantity of sewage. Down-stream, from Dunaföldvár (the table indicating the 1560th river kilometre) to the Yugoslavian–Hungarian frontier (1433rd river kilometre) extends the part of the Hungarian Danube section which has changed least of all regarding its natural conditions, related to the ones mentioned above. There is no local water contamination in notable quantity here as yet, what there is to be found arrives from upper sections. Also in this part flood-control and river regulation have considerably interfered with the life of the river, still one can find major flood plains and larger or smaller branches connected with the Danube.

So that one can appraise the distribution of carp and the trend of the catches of carp in the Hungarian Danube section, one should know the data pertaining thereto, assembled relying upon the statistics of fishery in the past 21 years.

Table I

Data on the catches of carp in the Hungarian section of the Danube between 1950 and 1970, in kilogrammes

1950	1951	1952	1953	1954	1955	1956	1957
35 291	51 313	76 926	69 556	55 442	75 800	86 676	81 904
1958	1959	1960	1961	1962	1963	1964	1965
78 544	87 676	88 431	96 245	106 206	139 907	117 423	110 278
1966	1967	1968	1969	1970			
153 825	136 287	142 043	139 066	176 915			

Table II

Occurrence of carp in the Hungarian section of the Danube between 1950 and 1970, expressed in the percentage of the total catches of the single years

1950	1951	1952	1953	1954	1955	1956	1957
7,9	7,7	10,1	10,2	8,1	10,6	12,9	11,2
1958	1959	1960	1961	1962	1963	1964	1965
10,4	10,8	11,1	11,1	12,2	15,7	13,8	11,5
1966	1967	1968	1969	1970			
12,9	11,9	13,2	15,6	17,6			

Consequently, 100.274 kg. of carp are being caught on a yearly average in the Hungarian section of the Danube, as calculated from the data of the hauls of the past 21 years. On an average, this is 11.7% of the yearly average total catches. However, in order that these overall data can be appraised with regard to the ecological conditions changing and differing with the various parts of the river, one should analyse them in a somewhat greater detail, broken down regionally.

In the following, the Hungarian Danube section will be discussed broken down to three parts. Part marked I extends from the upper Hungarian frontier (1850th river kilometre) to Szob (1707th river kilometre). This part includes the whole surface of the main branch of the river belonging under Hungarian jurisdiction as well as all flood plains, floodplain branches and lakes, the lower reaches of the tributaries and inflowing brooks, further the Moson branch; its whole surface amounts to 5814 hectares, which is 23.4% of the area of the whole Hungarian Danube section. 75.2% of it is the so-called live watercourses, which thus mean reaches of streaming flow and 24.8% is an area of stagnant water or of branches of quite slow flow, or lakes and canals. The main branch of the Danube forms the frontier between Czechoslovakia and Hungary in this part. Table 3 presents the catches of carp attained each year between 1950 and 1970.

Table III

Data on the catches of carp in Part I. of the Hungarian section of the Danube between 1950 and 1970; (kilogrammes)

1950	1951	1952	1953	1954	1955	1956	1957
1 443	7 919	4 774	8 902	9 771	23 538	9 783	15 078
1958	1959	1960	1961	1962	1963	1964	1965
19 087	22 371	13 499	26 278	21 274	29 763	20 877	36 325
1966	1967	1968	1969	1970			
19 777	45 011	52 014	49 801	57 754			

Table IV

Occurence of carp in Part I. of the Hungarian section of the Danube between 1950 and 1970, expressed in the percentage of the total catches in the single years

1950	1951	1952	1953	1954	1955	1956	1957
1,7	4,9	2,5	4,8	5,5	11,4	5,7	8,3
1958	1959	1960	1961	1962	1963	1964	1965
11,2	11,0	7,6	12,2	10,7	14,8	9,6	14,2
1966	1967	1968	1969	1970			
7,9	15,3	17,8	17,8	22,0			

The Part marked II extends from Szob, the 1707th, to Dunaföldvár, the 1560th river kilometre. Its full area is 9171hectares, 37% of the whole Hungarian section of the river. As mentioned above, in consequence of intense regulation hardly any flood-plains, branches and backwaters are to be found in this part. 97.9% of the whole area can be qualified as live waterflow, only 2.1% of it are branches or backwaters. Table 5 presents the amount of the yearly catches of carp in this Part between 1950 and 1970.

Table V

Data on the catches of carp in Part II. of the Hungarian section of the Danube between 1950 and 1970; (kilogrammes)

1950	1951	1952	1953	1954	1955	1956	1957
3 749	2 169	8 010	3 086	2 598	1 587	2 283	4 214
1958	1959	1960	1961	1962	1963	1964	1965
11 532	7 674	8 107	2 576	2 247	2 150	4 015	3 796
1966	1967	1968	1969	1970			
3 825	4 127	12 521	11 482	12 576			

Table VI

Occurrence of carp in Part II. of the Hungarian section of the Danube between 1950 and 1970, expressed in the percentage of the total catches of the single years

1950	1951	1952	1953	1954	1955	1956	1957
4,3	3,9	11,1	5,2	4,5	3,2	3,7	4,0
1958	1959	1960	1961	1962	1963	1964	1965
8,0	4,7	4,2	1,4	1,9	1,0	2,2	1,9
1966	1967	1968	1969	1970			
1,7	2,1	5,5	5,2	7,1			

The Part marked III extends from Dunaföldvár (1560th river kilometre) to the Yugoslav-Hungarian frontier (1433rd river kilometre). Its area amounts to all in a111 9816 hectares, 39.6% of that of the whole Hungarian section of the Danube. As already mentioned, the most extensive inundation area of the Hungarian Danube is to be found here, and this is the part where several branches and backwaters of considerable extent are in connection with the main branch. 82.5% of the whole area can be qualified as live waterflow, 17.5 is made up of branches, backwaters and lakes in the flood plain.

Table 7 presents the catches of carp attained in this part every year between 1950 and 1970.

Table VII

Data on the catches of carp in Part III. of the Hungarian section of the Danube between 1950 and 1970; (kilogrammes)

1950	1951	1952	1953	1954	1955	1956	1957
30 099	41 225	64 142	57 568	43 073	50 675	74 610	62 612
1958	1959	1960	1961	1962	1963	1964	1965
47 925	57 631	66 825	67 391	82 685	107 994	92 531	70 157
1966	1967	1968	1969	1970			
130 223	87 149	77 508	77 783	106 585			

Table VIII

Occurrence of carp in Part III. of the Hungarian section of the Danube between 1950 and 1970, expressed in the percentage of the total catches of the single years

1950	1951	1952	1953	1954	1955	1956	1957
10,9	9,5	13,0	13,2	9,5	11,1	17,1	14,2
1958	1959	1960	1961	1962	1963	1964	1965
10,9	13,0	15,6	15,4	18,2	22,2	20,5	13,7
1966	1967	1968	1969	1970			
17,9	13,5	13,8	19,7	18,7			

	Average catch of carp p. a.		Area	
	kg	%	hectares	%
In the whole Hungarian Danube section	100 274	100,0	24 801	100,0
in Part I.	23 573	23,5	5 814	23,4
in Part II.	5 444	5,4	9 171	37,0
in Part III.	71 256	71,1	9 816	39,6

The presented data as well as the average values and territorial distribution calculated from them vividly demonstrate the measure in which the separately discussed three Parts differ as compared with one another. The dissimilarity of the results of fishery points to obvious ecological differences. It appears that the most favourable conditions for the stock of carp are to be found in Part III. The fact that the region including the widest floodplain yields the greatest amount of carp in the Hungarian section of the Danube refers to the circumstance that the mechanism described earlier by A n t i p a is basically still operating and that M. R i s t i č s opinion that namely a reconstruction of the inundation areas would increase the yield in fish, is still correct – at least as regards the discussed IIIrd part of the Hungarina Danube section. In Parts I. (owing to the dissimilar hydrographic conditions) and II. (owing to the highly advanced and irrecoverable stage the changes have attained) no notable results can be achieved any more by reconstructing the inundation areas or such reconstruction is not even possible any more.

The naturally developed system in the connection of the river and its branches as well as flood-plains, further in the production of fish ceased to exist. This circumstance prompted the fisheries to atain by artificial intervention a trend which was favourable for them in the development of the stock of fish. As most direct intervention they introduced young carp reared in hatcheries into the reaches and branches of the Hungarian Danube section suitable for this.

When examining the data of the above Tables on the catches of carp in the Hungarian section of the Danube and its parts, one can see the differences appearing between the values of the single years. Further also the process taken place in the conditions of catching carp and in the trend in its stock in the said section between 1950 and 1970 are discernible. With a view to expressing the data more descriptively, the author of the present paper also presents graphs. These were drawn up in a way that the yearly average catches of carp was taken 100% and the percentage which the data on the p. a. catches represented between 1950 and 1970 was calculated. Numerous causes underlie the changes to be observed in the yearly data, several factors of ecological character affect the stock of fish living in a given section of the Danube. Besides the more complicated natural factors simpler phenomena connected with water movement,

with river regulation or maybe with contamination determine the changes ensuing in the density and number of the population of carp. The introduction of young fish into the Hungarian section of the Danube can also be considered as a cause of such changes. Fry was introduced each year during the whole period, i. e. from 1950 to 1970, however, in markedly smaller quantities in the period before 1960 than subsequently to that year. Before 1960 the changes to be observed in the catches of carp were for their most part consequences of favourable or unfavourable trends in natural factors. After 1960 – although the effect of natural factors of such kind can also be observed at that time – the marked increase observed in the catches of carp is expressly a consequence of the introduction of fry in great quantities. The material of such introductions was at all times second-summer carp hatched in fish-ponds; parasitologically controlled healthy individuals of at least 25 dkg. average weight. Although they came in considerable quantities into the very main branch of the Danube, the majority was introduced into branches, backwaters and lakes of the flood-plain. By minor technical interventions these areas were in most cases made suitable for retaining the water or for its being drained off, as well as for fishery itself. Several of them are being managed so-to-say like fish-farms, the introduced carp are also foraged. As to what a successfully performed introduction of young fish can mean, of this a good example is presented in the graph on the changes in the catches of carp in Part II of the Hungarian Danube section. The outstanding results achieved here in the years 1968, 1969 and 1970 can be ascribed to a locked backwater of not more than 21 hectares, where the carp introduced in great numbers were also foraged over the whole year. Equally good results could be achieved with similar methods also in Parts I and II. However, it should be noted that the circumstance that in certain backwaters of relatively small extent a suitable method for attaining favourable results could be found does not relieve of the task to do something for the development, or to put it more correctly, for the reconstruction of the stock of carp in the whole of the Danube. This cannot be achieved by introducing great quantities of carp from hatcheries either. The Danube itself (regulated only in the interest of shipping so far) should be made a suitable site of spawning, feeding and winter preservation of the autochthonous stock of carp living there. The silting outlets of the branches have to be cleaned and deepened in the way suggested by M. RISTIČ in the study quoted above since it is generally through these that the stock of fish streams to the spawning and feeding areas in various directions, thrugh them it gets back to the main branch of the Danube at times the river recedes, and into them the fish swim over for wintering at autumn time. This work obtains special weight by the Iron Gate Water-Power Station under construction at present and by the new situation resulting from its establishment, a situation fullyi different from the one prevailing up to now. Owing to the masses of organic matter of autochthonous and allochthonous origin delivered by the flow and accumulating there, and in consequence of the slackening stream, the extensive area of water dammed

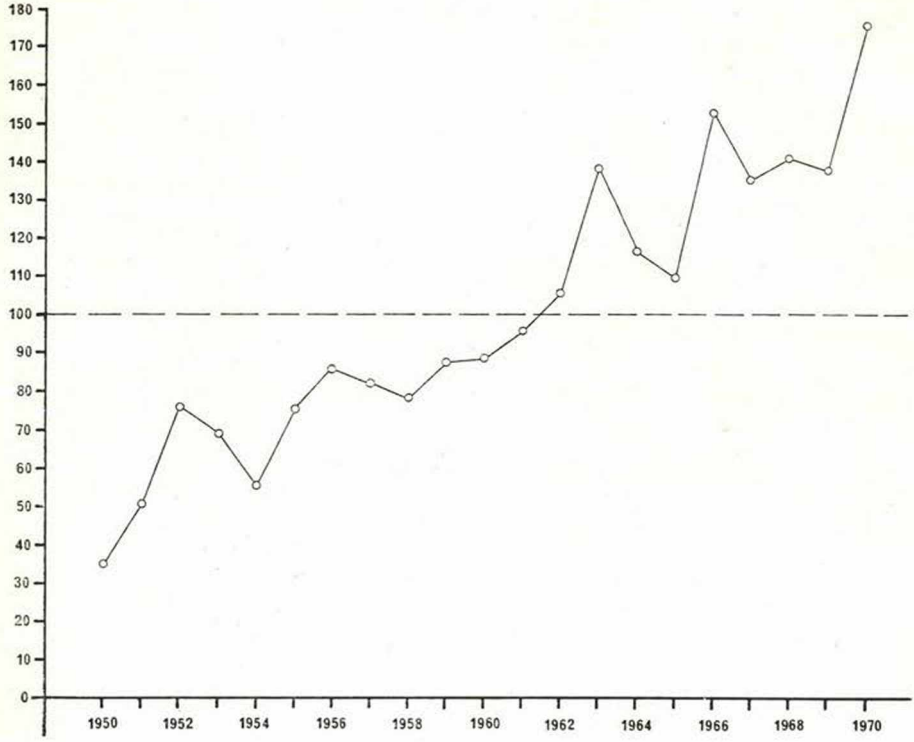

Figure 1.

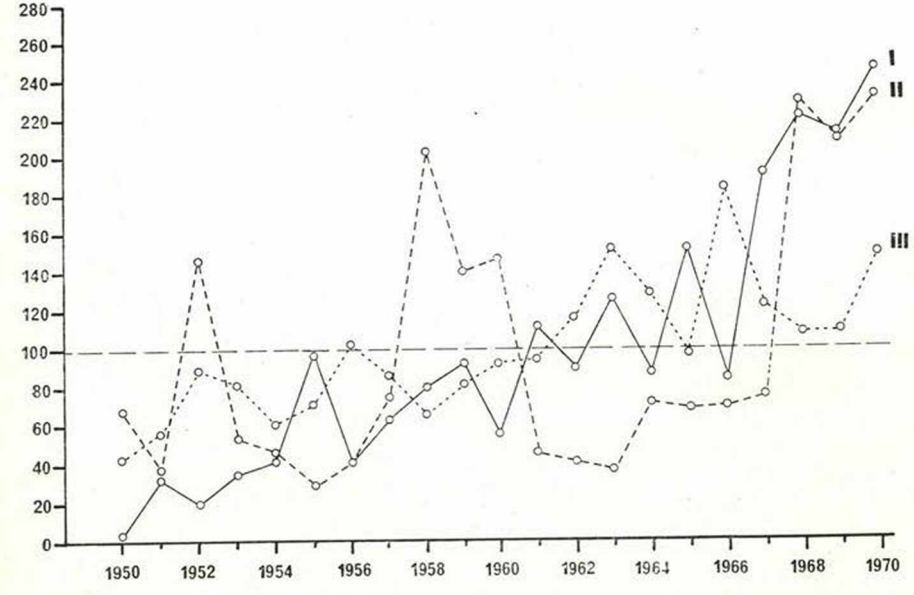

Figure 2.

up by the Water-Power Station can become an excellent biotop for carp. At its spawning-time migration the carp stock developing there spreads over an extensive area and wanders over wide distances (as this was obwerved and described by A n t i p a in his time). Within the new system to be formed following the construction of the Iron Gate Water-Power Station the part of the Hungarian Danube section above the Dráva mounding up to Paks will become a fundamentally important spawning area of the naturally developing population of carp.

Summing up one can state that in the Hungarian section of the Danube there had been achieved certain results in carp fishing, still, while on the one hand this can be considered a success since it could be attained under generally decreasing quantities caught, on the other hand it should be noted that a success of this kind could be realized in the first place by a costly and intense restocking of certain branches of the river and that simultaneously the original authochthonous carp stock shrunk to a minimum.

The method discussed has to be adopted also in the future in each of the said three parts of the Hungarian Danube. In the Ist Part most probably further significant results can be achieved by it; no success can be expected from any method in the IInd Part at present and not even the discussed prodedure can bring satisfactory results since no branches and backwaters suitable for this are to be found there. Besides an intensive planting of carp in the areas suitable for this, urgent measures have to be taken in the IIIrd Part – in harmony with similar dispositions on Yugoslavia's part – for saving the autochthonous carp pouplation of the Danube and for enabling the formation of a new stock in the situation ensuing after the Iron Gate Water-Power Station has been constructed.

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